

# PATENT SPECIFICATION

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## (54) ADHESIVE MATERIALS

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 formerly known as Neptune Street, Kingston-  
 upon-Hull, Yorkshire) do hereby declare the  
 invention, for which we pray that a patent  
 may be granted to us, and the method by  
 which it is to be performed, to be particu-  
 larly described in and by the following state-  
 ment:—

The present invention relates generally to  
 adhesive materials for use on animal bodies  
 particularly human bodies. Examples of such  
 materials are: adhesive bandages, plasters,  
 dressings, surgical drapes, and decorative cos-  
 metic products.

Where adhesive material are to be used  
 on parts of animal bodies e.g. human bodies  
 it is desirable to have an adhesive material  
 which is permeable to water vapour, but  
 which is not permeable to liquid water, micro-  
 organisms and particles of dirt. These con-  
 ditions are desirable in order to provide the  
 desired covering without causing maceration  
 due to occlusion of water from transepidermal  
 water loss from the body. Many methods have  
 been tried in order to obtain the results set  
 out above. Methods at present in use involve  
 the use of perforated, porous or microporous  
 backing material having a porous or pattern  
 spread adhesive layer. Such constructions  
 however do not provide a barrier to low  
 surface tension aqueous solutions e.g. wash-  
 ing up liquid (which will also allow bacteria  
 to penetrate). Furthermore large holes in the  
 material are not bacteria proof and small

holes are subject to being blocked by grease  
 etc. Special processes are also needed to pro-  
 duce such materials.

According to the present invention there  
 is provided a moisture vapour permeable pres-  
 sure sensitive adhesive material for use on  
 animal skin and nails, comprising a backing  
 material having a pressure sensitive adhesive  
 on at least substantially the whole of the  
 body-adhering portion of at least one surface  
 of said backing material, both said backing  
 material and said adhesive being moisture  
 vapour permeable and unaffected by water and  
 at least one of said backing material and  
 said adhesive comprising a synthetic polymer  
 and being continuous and non-permeable to  
 liquid water, said adhesive material having  
 a moisture vapour permeability of at least  
 300 g./sq.metre/24 hours/40° C./80 per-  
 cent relative humidity (R.H.).

For the synthetic polymer used to form  
 the continuous backing material and/or the  
 continuous adhesive to have the properties  
 desired it should not be highly crystalline,  
 should not have a high proportion of hydro-  
 gen bonding and should include hydrophilic  
 groups.

Evidence from various sources indicate that  
 the average body loss of water through the  
 skin excluding visible sweat is in the region  
 of 250 g./sq.metre/24 hours. Areas such as  
 the palm of the hand and soles of the feet  
 have a high water loss in the region of 500  
 g./sq.metre/24 hours.

It follows that a permeability of at least  
 300 g./sq. metre/24 hours/40° C/80 percent

R.H. is required for most areas but a figure of 500 is preferred especially for wound dressings and surgical drapes.

The adhesive may be applied as an all over spread (continuous or discontinuous) to one surface of the backing material or the adhesive may be applied to body adhering portions only to form for example a window dressing, i.e. one in which the wound covering area of the backing material is not coated with adhesive.

It is clear that either the backing material or the adhesive, or both, may be continuous and non-permeable to liquid water. All such arrangements have a number of common advantages, for example the moisture vapour permeability feature allows the skin etc., to breathe thereby preventing maceration and the impermeability to liquid water feature prevents ingress of water and egress of wound exudate where the material is used on a wound. The feature that both the adhesive and the backing material are unaffected by water allows the dressing to be immersed in water without adverse effect. Each of the three different embodiments of the invention, however, has its own particular advantages and the arrangement used for any particular purpose should be selected bearing in mind these advantages. For example, in embodiments where only the backing layer is continuous and impermeable to water, dirt and water are prevented from passing through the backing layer to the adhesive which may then allow the water and dirt to reach the body. The arrangement where only the adhesive is impermeable to water will prevent wound exudate from passing through the adhesive. The arrangement where both the adhesive and the backing material are continuous and impermeable to water is particularly preferred since this has the advantages given above for the arrangement where only one of the backing material and adhesive is continuous. Furthermore the manufacture of this embodiment is simplified since each of the layers may be produced in a continuous manner. Also the possibility of pin-holes in the backing layer and the adhesive coinciding is less when two continuous layers are used since any such pin-holes present are accidental. Furthermore strike through of adhesive through the backing layer is prevented.

The expression "continuous" as used throughout the present specification, including the claims, is intended to mean that the material is such that it contains no discontinuities which are visible, either by the naked eye or under an optical microscope, and are such that water vapour passes through such materials by intermolecular diffusion. The polymer may be visualised as a tangled mass of polymer chains with approximately molecular sized holes between them. At normal temperatures there is considerable segmental

mobility and the holes are continually forming and disappearing as a result of thermal motion. Diffusion of a penetrant takes place as a succession of "jumps" from hole to hole.

The diffusion of a gas or vapour through such a "continuous" material does not depend on the fluid properties of the gas or vapour but on the structures of the gas or vapour and the continuous material and chemical affinity of one for the other.

In the specification, including the claims the expression "unaffected by water" when used to describe the backing material and/or the adhesive is intended to mean that the backing material and/or adhesive does not on contact with water lose those properties which would effect its performance as a backing or adhesive e.g. a) the adhesive does not lose adhesion or cohesion due to solution and does not swell to cause the dressing etc. to come off and, b) the backing does not lose its tensile strength, disintegrate or become tacky.

Where reference is made to moisture vapour permeability it is intended that such measurements are carried out by the Payne cup method, carried out as follows:—

10 mls. of distilled water are added to the cup. A 2 1/4" diameter sample of the material to be tested is clamped above the opening from the cup. Where an adhesive is being tested this should first be coated onto a highly permeable backing for support. The arrangement is then placed in an air circulating oven at temperatures of 40° C. and relative humidity of 20% for 24 hours. There is therefore a difference between the relative humidity inside the cup and the relative humidity outside the cup. The loss of water from the cup is found by weighing. The moisture vapour permeability is expressed as grams/square metre/24 hours/40° C./80% RH for the particular material.

The expression "pressure sensitive adhesive" as used throughout the specification, including the claims, is intended to mean an adhesive which is inherently tacky, viscoelastic and cohesive in its normal dry state. Clearly the adhesive used must be capable of adhering to that part of the body to which it is to be attached.

Where reference is made to adhesive being on "substantially the whole of the body-adhering portion of the backing material" it is not intended to exclude the possibility of the adhesive being discontinuous to an extent sufficient to provide the body-adhering portion with an average m.v.p. of at least 300.

The adhesive materials of the invention should be non-toxic, non-irritant, conformable and should maintain their properties over a range of conditions and time. The backing

material should be non-tacky under conditions of use.

The adhesive materials may be used on any part of the human body, e.g. for surgical, dermatological or cosmetic use. Some examples of specific uses of the adhesive material of the invention are as surgical drapes, suture strips and sheets, adhesive dressings, bandages, plasters, decorative nail coverings, solid eye liners, wrinkle producers (for theatrical make up) etc.

The adhesive materials of the present invention may result in one or more of the following advantages:

1. Prevent occlusion of moisture under the structure which can injure the skin or nail.
2. Allow oxygen through from the outside. This is important to healing of wounds.
3. Prevent ingress of liquid water.
4. Prevent ingress of bacteria.
5. Are unaffected by water.

Some degree of isotropic elasticity in the backing material is desirable for some applications. This is however not essential, and non-elastic backing materials such as cretonne may be used, if desired.

Continuous adhesives may be formed from polymers containing hydrophilic groups such as hydroxyl, carboxyl, amine, amide, ether and alkoxy providing that the adhesives are not soluble or highly swollen in water.

However water soluble or water swellable polymers can be added to permeable pressure sensitive formulations to increase their permeability provided they are compatible and do not cause the adhesives to be affected by water (for example a polyvinyl methyl ether may be added to a polyvinylethyl ether adhesive or a hydroxy propyl acrylate homopolymer may be added to a compatible pressure sensitive adhesive); other water soluble or water swellable polymers which may be used are cellulose esters, polyvinyl alcohol and other hydrophilic materials. Similarly water soluble monomers can be used in water insensitive copolymers.

Examples of materials which may be used as the continuous adhesive are a blend of vinyl ethers or an acrylic polymer, with or without the addition of tackifying resins. Hydroxy acrylate polymers, may also be used in suitable formulations.

Preferred water impermeable adhesives are polyvinyl ethyl ethers and certain acrylate ester copolymers containing hydrophilic groups.

The polyvinyl ethyl ether adhesives may be obtained in a wide range of viscosities. A particularly preferred polyvinyl ethyl ether adhesive is a composition comprising the following ingredients:

|    |                           | Amount<br>(Parts by weight except<br>where stated). |
|----|---------------------------|---|
| 65 | Ingredient                |   |
|    | Bakelite EDBC (see below) | 50  |
|    | Bakelite EHBM (see below) | 100 (solution as received)                          |
|    | Kelrez ZR142 (see below)  | 25  |
|    | Antioxidant (Nonox WSL)   | 3   |
|    | 60-80 petroleum ether     | 300 mls.  |

Polyhydroxy propyl acrylate is a tacky rubbery polymer which may be converted into a pressure sensitive adhesive composition by copolymerisation with another monomer. The homopolymers generally cross-link during polymerisation but linear polymers may be obtained by solvent polymerisation provided the concentration of monomer is low.

Suitable acrylate ester copolymer adhesives found so far as Acronal KR 2156 (B.A.S.F.) and D.260 (Shawinigan). Blends of acrylic and polyvinyl ethers found to be useful as adhesives include a) a mixture of 50 parts by weight Acronal 40D (B.A.S.F.) and 50 parts by weight Lutonal M 40 and b) a mixture of 100 parts by weight Gantrez M 574, 50 parts by weight Gelva D 260 and 25 parts by weight of Kelrez ZR 142.

Where a continuous adhesive is used, the adhesive may be applied to the backing material in solution, aqueous dispersion, as a hot melt, or by a transfer process, using known techniques, e.g. knife, roller coating or curtain coating methods. In practice the

transfer process has been found to be particularly convenient. The adhesive solution is spread on release coated paper, and almost dried before contacting the backing material under sufficient pressure to ensure good contact. The release paper is then removed. Other methods may however prove to be more practicable in commercial use.

Any suitable adhesive may be used where the adhesive is to be discontinuous. The discontinuities should not be too big i.e. the adhesive layer should contact the skin etc. over most of the area of the dressing.

The adhesive can be made porous by foaming, leaching out soluble fillers, pattern spreading, e.g. as shown in British Patent 819,635 spraying or selective layer perforating.

Where the backing material is continuous any material which is continuous and is water vapour permeable but liquid water impermeable may be used, although for many uses other properties e.g. conformability and oxygen permeability are desirable.

Useful materials include cast films of thermoplastic polyurethane and other polymers containing non-bound (free to interact with water) hydrophilic groups (e.g. —OH, —COOH, —NH<sub>2</sub>, —NH, alkoxy and ether etcetera) provided they are unaffected by water, as defined above.

Preferred continuous backing materials are:—

- 10 I. A copolymer obtainable by copolymerizing an hydroxy alkyl acrylate or methacrylate with an alkoxy alkyl acrylate or methacrylate and optionally with a minor amount of a further monomer.

- 15 Copolymers of this type are described in G.B. Application 50044/68 (Serial No. 1278572).

- 20 If desired more than one hydroxyalkyl acrylate or methacrylate and/or more than one alkoxy alkyl acrylate or methacrylate may be used as monomers.

Preferably the minor amount of further monomer is no more than 10% by volume based on the total volume of monomers.

- 25 Preferred further monomers are acrylic acid, methacrylic acid acrylamide, mono- and diacrylates of glycols and polyglycols, (e.g. glycerol and polyalkylene glycols), mono- and dimethacrylates of glycols and polyglycols (e.g. glycerol and polyalkylene glycols, glycidyl acrylates and glycidyl methacrylates.

- 30 The further monomer or monomers may be present as an impurity in the major constituents of the reaction mixture or may be specifically added e.g. to provide for cross-linking.

- 40 The preferred hydroxy alkyl acrylates and methacrylates are hydroxy ethyl methacrylates (HEMA), hydroxy propyl acrylates (HPA) and hydroxy propyl methacrylates (HPMA).

Preferred alkoxy alkyl acrylates and methacrylates are ethoxy ethyl methacrylates (EEMA) and methoxy ethyl methacrylates (MEMA).

- 45 The properties of these copolymers will vary depending on the proportions of the various ingredients used to make up the copolymer. In general copolymers with a high proportion of alkoxy alkyl acrylate or methacrylate (e.g. EEMA) give flexible, high moisture vapour permeable, non water-swella-
- 50 ble films at 20° C. whereas a high proportion of a hydroxy alkyl methacrylate (e.g. HEMA) will give high moisture vapour permeable, brittle, water swellable, films (properties at 20° C.). For example, a copolymer made up from 80% by volume EEMA and 20% by volume HEMA is flexible and is not
- 55 affected by water, whereas a copolymer made up from 50% by volume EEMA and 50% by volume HEMA is brittle and is swollen by water.

- 60 Copolymers including more than 30% hydroxy ethyl acrylate or methacrylate are effected by water and are thus not included as

materials which can be used as backing materials in the present invention.

These copolymers may be prepared by copolymerising an hydroxy alkyl acrylate or methacrylate with an alkoxy alkyl acrylate or methacrylate and optionally with a minor amount of a further monomer. A free radical initiator, for example, tertiary butyl peroxoate may be used. The reaction may be performed in a solvent such as ethyl acetate, industrial methylated spirits, ethanol, methanol, dimethyl formamide. The reaction is performed in an inert atmosphere under reflux for 8 hours. The copolymer may be precipitated by pouring into a non-solvent such as petroleum ether.

Alternatively, the above reaction may be taken to near completion by refluxing, e.g. for 24 hours, to give a solution of the copolymer. Films may be formed from the solution of the copolymer by casting a solution of the copolymer onto a smooth surface, for example release coated silicone paper or cast polypropylene, drying and stripping the film off the smooth surface. To improve strength characteristics the copolymers may be self cross-linked by heating or may be cross-linked by the addition of a cross-linking agent or a catalyst. A copolymer of 80% by volume EEMA and 20% by volume HEMA may be partially self cross-linked by heating at 120° C for 1 1/2 hours or longer in air atmosphere.

II. Homopolymers of alkoxy alkyl acrylates or methacrylates (linear or cross-linked) or from copolymers of one or more (preferably one) alkoxy alkyl acrylate or methacrylate with one or more (preferably one) alkyl acrylate or methacrylate.

The moisture vapour permeability is reduced as the proportion of alkyl acrylate or methacrylate is increased. Care should therefore be taken to ensure that, in the final product, the moisture vapour permeability is at least 300. By careful selection of the proportion of alkyl acrylate or methacrylate, the thickness of the backing material and the nature and thickness of the adhesive.

Preferred monomers are an ethoxy ethyl methacrylate (EEMA); a methoxy ethyl methacrylate (MEMA); and methyl methacrylate (MMA).

III. A copolymer obtainable by reacting an alkoxy alkyl acrylate or methacrylate with a different alkoxy alkyl acrylate or methacrylate. Copolymers of this type are described in our GB Application No. 60754/68 (Serial No. 1278572). Although it is preferred that no monomers other than alkoxy alkyl acrylates or methacrylates or polymers formed therefrom are present in the reaction mixture, up to 10% of further monomers (see list above under I) may be present.

Where reference is made to no monomers than alkoxy alkyl acrylates or methacrylates or polymers being present, it is to be

Useful materials include cast films of thermoplastic polyurethane and other polymers containing non-bound (free to interact with water) hydrophilic groups (e.g. —OH, —COOH, —NH<sub>2</sub>, —NH, alkoxy and ether etcetera) provided they are unaffected by water, as defined above.

Preferred continuous backing materials are:—

I. A copolymer obtainable by copolymerizing an hydroxy alkyl acrylate or methacrylate with an alkoxy alkyl acrylate or methacrylate and optionally with a minor amount of a further monomer.

Copolymers of this type are described in G.B. Application 50044/68 (Serial No. 1278572).

If desired more than one hydroxyalkyl acrylate or methacrylate and/or more than one alkoxy alkyl acrylate or methacrylate may be used as monomers.

Preferably the minor amount of further monomer is no more than 10% by volume based on the total volume of monomers.

Preferred further monomers are acrylic acid, methacrylic acid acrylamide, mono- and diacrylates of glycols and polyglycols, (e.g. glycerol and polyalkylene glycols), mono- and dimethacrylates of glycols and polyglycols (e.g. glycerol and polyalkylene glycols, glycidyl acrylates and glycidyl methacrylates).

The further monomer or monomers may be present as an impurity in the major constituents of the reaction mixture or may be specifically added e.g. to provide for cross-linking.

The preferred hydroxy alkyl acrylates and methacrylates are hydroxy ethyl methacrylates (HEMA), hydroxy propyl acrylates (HPA) and hydroxy propyl methacrylates (HPMA).

Preferred alkoxy alkyl acrylates and methacrylates are ethoxy ethyl methacrylates (EEMA) and methoxy ethyl methacrylates (MEMA).

The properties of these copolymers will vary depending on the proportions of the various ingredients used to make up the copolymer. In general copolymers with a high proportion of alkoxy alkyl acrylate or methacrylate (e.g. EEMA) give flexible, high moisture vapour permeable, non water-swellaible films at 20° C. whereas a high proportion of a hydroxy alkyl methacrylate (e.g. HEMA) will give high moisture vapour permeable, brittle, water swellaible, films (properties at 20° C.). For example, a copolymer made up from 80% by volume EEMA and 20% by volume HEMA is flexible and is not affected by water, whereas a copolymer made up from 50% by volume EEMA and 50% by volume HEMA is brittle and is swollen by water.

Copolymers including more than 30% hydroxy ethyl acrylate or methacrylate are effected by water and are thus not included as

materials which can be used as backing materials in the present invention.

These copolymers may be prepared by copolymerising an hydroxy alkyl acrylate or methacrylate with an alkoxy alkyl acrylate or methacrylate and optionally with a minor amount of a further monomer. A free radical initiator, for example, tertiary butyl peroxoate may be used. The reaction may be performed in a solvent such as ethyl acetate, industrial methylated spirits, ethanol, methanol, dimethyl formamide. The reaction is performed in an inert atmosphere under reflux for 8 hours. The copolymer may be precipitated by pouring into a non-solvent such as petroleum ether.

Alternatively, the above reaction may be taken to near completion by refluxing, e.g. for 24 hours, to give a solution of the copolymer. Films may be formed from the solution of the copolymer by casting a solution of the copolymer onto a smooth surface, for example release coated silicone paper or cast polypropylene, drying and stripping the film off the smooth surface. To improve strength characteristics the copolymers may be self cross-linked by heating or may be cross-linked by the addition of a cross-linking agent or a catalyst. A copolymer of 80% by volume EEMA and 20% by volume HEMA may be partially self cross-linked by heating at 120° C for 1 1/2 hours or longer in air atmosphere.

II. Homopolymers of alkoxy alkyl acrylates or methacrylates (linear or cross-linked) or from copolymers of one or more (preferably one) alkoxy alkyl acrylate or methacrylate with one or more (preferably one) alkyl acrylate or methacrylate.

The moisture vapour permeability is reduced as the proportion of alkyl acrylate or methacrylate is increased. Care should therefore be taken to ensure that, in the final product, the moisture vapour permeability is at least 300. By careful selection of the proportion of alkyl acrylate or methacrylate, the thickness of the backing material and the nature and thickness of the adhesive.

Preferred monomers are an ethoxy ethyl methacrylate (EEMA); a methoxy ethyl methacrylate (MEMA); and methyl methacrylate (MMA).

III. A copolymer obtainable by reacting an alkoxy alkyl acrylate or methacrylate with a different alkoxy alkyl acrylate or methacrylate. Copolymers of this type are described in our GB Application No. 60754/68 (Serial No. 1278572). Although it is preferred that no monomers other than alkoxy alkyl acrylates or methacrylates or polymers formed therefrom are present in the reaction mixture, up to 10% of further monomers (see list above under I) may be present.

Where reference is made to no monomers that than alkoxy alkyl acrylates or methacrylates or polymers being present, it is to be

understood that the reaction mixture may include very small amounts of the free acids as impurities.

- 5 These copolymers may be produced by copolymerising in an inert atmosphere an alkoxy alkyl acrylate or methacrylate with a different alkoxy alkyl acrylate or methacrylate.

- 10 The reaction may be performed in the presence of a free radical initiator, for example, tertiary butyl peroxoate.

The reaction may be performed in the absence of a solvent or in the presence of a solvent e.g. ethyl acetate, toluene, methanol or dimethyl formamide.

- 15 The copolymer may be precipitated by pouring into a non-solvent such as petroleum ether. Alternatively the reaction may be taken to completion by heating for a suitable length of time, e.g. for 24 hours, to give a solution of the copolymer. Films may be formed from a solution of the copolymer by casting the solution onto a smooth surface, for example, release coated silicone paper or cast polypropylene, drying and stripping the

film from the smooth surface. The properties of the films and coatings of the copolymer of the invention depend on the type and proportion of the monomers. For example, copolymers of an ethoxy ethyl methacrylate (EEMA) and a methoxy ethyl methacrylate (MEMA) and containing a high proportion of MEMA will tend to be stiff and brittle at temperatures in the region of 5° C. whereas similar copolymers containing a large proportion of EEMA will be flexible.

IV. Thermoplastic polyurethane films. Suitable films can be made by extrusion or preferably by solvent casting. Suitable materials, and their production are described in U.S. Patent No. 2871218. Eastane 5701 and 5702 (B. F. Goodrich Co.) have been found to be particularly satisfactory. Eastane 5702 has been found to be the most useful of these materials. "Eastane" is a registered Trade Mark.

This material is best cast as a tetrahydrofuran or acetone solution.

Properties of a 1 mil thick film of Eastane 5702 are:—

|    |   |                                      |
|----|---|--------------------------------------|
| 50 | MVP                                     | 1620 g.s.m./24 hr.                   |
|    | O. permeability                         | 4880 cc/m <sup>2</sup> /Atmos/24 hr. |
|    | Tensile strength (p.s.i.)               | 5300                                 |
|    | Elongation                              | 730%                                 |
|    | Modulus at 300% extension (p.s.i.)      | <500                                 |
|    | Hardness (Durometer A)                  | 70                                   |
| 55 | Low temperature brittleness point (° F) | <-100                                |

- Where the backing material is not continuous any material having high moisture vapour permeability may be used provided it is not affected by water. In addition it is desirable for such backing material to be such that it acts as a screen for larger particles of solid materials such as dirt.

- 60 Examples of materials which may be used to form non-continuous backing material are microporous films of plasticised polyvinyl chloride (process for making such microporous film of p.v.c. is described in U.K. Specification No. 884232), and certain non-woven and woven and knitted porous fabrics. Fabrics which may be used as the backing material include non-woven fabrics based on cellulose or synthetic polymer fibres which may be crimped and/or laid down in such a manner as to give an elastic fabric. A preferred type of fabric having the desirable properties of omni-directional stretch combined with high porosity and high strength even when wet, is that type of fabric based on extruded composite synthetic fibres sold under the trade mark "Heterofil" by Imperial Chemical Industries Limited. "Heterofil" is a registered Trade Mark.

- 80 Several of the spun-loaded polyester fabrics marketed as "Reemay" fabrics by du Pont and similar fabrics by Bondina Ltd. are similarly suitable. "Reemay" is a registered Trade Mark.

In some cases the adhesive may be applied directly to the backing materials. In other cases however a water vapour permeable tie coating continuous or discontinuous may be needed to obtain adequate keying between the adhesive and the backing material. For example acrylic and plasticised PVC films may be coated with some adhesives directly, without need for a primer coat, e.g. where the adhesive used is a polyvinyl ethyl ether a tie coating is not usually required. However when using a backing material which includes nylon a primer coat is required in order to obtain adequate keying between the adhesive and backing material when wet. A suitable primer has been found to be a butadiene/vinyl-pyridine latex sold under the registered Trade Mark "Gentac".

In some instances when using a non-continuous backing material the exposed surface of the backing material has been found to "fluff up" badly, as well as becoming soiled. Also there is a tendency for the adhesive to strike through the backing material adding to the soiling problem. This may be overcome by applying a thin coat of a flexible and extensible material on the exposed surface of the backing material. In addition to consolidating the surface, this coating could also provide release properties useful when the product is used in a roll form, e.g. for bandaging and strapping. Suit-

able material which may be used are conventional release coats such as polystearyl methacrylate.

Where the material is to be used as a surgical dressing, a pad may be attached to the adhesive coated surface of the material.

The dressing pad when used is of conventional type and may, if desired, be made in situ by flocking vertically orientated fibres onto the adhesive surface.

Preferably a protector is provided to cover the adhesive which protector may be removed from the material immediately prior to use.

The protector, when used, may be a smooth release coated paper, e.g. a silicone release coated paper, but other thin suitable films inert to the adhesive may be employed.

The continuous portion of the material of the invention preferably has a high oxygen permeability especially where the material of the invention is to be used as a wound dressing.

Where the adhesive material of the invention is being stored in such a manner that the adhesive can come into contact with the backing material, e.g. if stored in the form of a reel, precautions must be taken to ensure the adhesive does not strongly adhere to the backing material. For example, the backing material may be provided with a release coating or a protector may be applied over the adhesive surface. This release coating may also serve to reduce soiling of the film in use.

If desired the backing film or adhesive layer or both may be given a pattern of thinner areas e.g. by embossing, to enhance the vapour and gas permeability of the layers.

One of the preferred uses of the present invention is in decorative cosmetic products, e.g. nail covers, eye liners, beauty spots, stage effects e.g. wrinkle producers (attach to skin in stretched state).

The preferred backing films for use in nail covers are copolymers of EEMA/HEMA (provided the amount of HEMA does not exceed 30% by volume; EEMA/HPMA: MEMA/EEMA: copolymers of MEMA with other monomers e.g. MEMA/HEMA (provided the amount of HEMA does not exceed 30% by volume); EEMA/MMA and homopolymers of MEMA. Particularly preferred are 80/20 (volume %) and 75/25 (volume %) copolymers of EEMA/HEMA; 9/10 (volume %) and 80/20 (volume %) copolymers of EEMA and MMA; and 80/20 (volume %) copolymer of EEMA/HPMA; 50/50, 60/40 and 70/30 MEMA/EEMA copolymers; 90/10 (volume %) and 80/20 (volume %) copolymers of MEMA/HEMA and cross-linked versions of these polymers. The film thickness is preferably from 1 to 3 mils.

The preferred adhesives for use in connection with the nail covers are polyvinyl ethyl

either based adhesives continuous film adhesives and foamed porous adhesives. The adhesive is preferably applied in an amount of from 5 to 75 grams per square metre. Nail covers are preferably glossy although they can have a matt finish. The films and/or adhesive may be pigmented or dyed. The films may have printing on them.

The nail covers are conveniently made up as a kit of two sets of six individual nail covers mounted in a range of sizes on a stiff release coated card.

The nail covers are removed from the nails by peeling or wiping with a special solvent. The material state to be preferred for nail covers are also preferred for other decorative cosmetic products.

Another particularly preferred use of the present invention is in forming adhesive medical and surgical dressings including first aid dressings and ward dressings.

The absorbent pad is generally placed centrally on the adhesive face of the material and the whole is preferably covered by a film or release coated paper protector. If desired, the dressings may be placed in a sterile pack e.g. on sterilised by ethylene oxide or by irradiation.

The preferred backing films and adhesives include those given in respect of the nail covers.

Other preferred backing materials are continuous thermoplastic polyurethane films, e.g. the Estanes (B. F. Goodrich) particularly Estane 5702 and 5701, and elastic fabrics coated with such materials or with poly EEMA. Preferred discontinuous backing materials are microporous p.v.c., spun-bonded non-woven fabrics, elastic woven fabrics and knitted fabrics.

Another preferred use of the present invention is in surgical drapes. These are large flexible sheets which are provided with a continuous layer of adhesive on at least a part only of one surface.

Where only a part of one surface is coated, the adhesive coated area may be varied with the design of the drape and a film or release coated protector is generally applied to the adhesive coated area. This protector is removed when it is desired to use the drape. Generally two uncoated margins are provided to enable the protector to be easily removed.

Alternatively, the coated margins may be covered by a releasable protector strip. The drapes may be packaged as a roll in a sterile pack and the shape of the drape may be varied to suit particular parts of the body.

Preferred materials, including both the backing material and the adhesive, are the same as those given for the nail covers. Another preferred backing material is a polyurethane film.

If desired, a bacteriostat may be incorpor-



ated into the surgical drape to prevent growth of infectious bacteria on its surface.

If desired, part of the surgical drape may be reinforced, for example the backing film may be reinforced with a light weight spun bonded non-woven fabric to prevent the film tearing or splitting, if particular strength is required.

The preferred surgical drapes of the present invention have a number of advantages as set out below:

1. Moisture vapour and oxygen permeable, waterproof and bacteria proof.
2. They may be left in position on the body for long periods which if considered desirable, enables:—
  - (a) The drape to be adhered over the proposed area of operation and the incision line marked on the drape during the preoperative period.
  - (b) The incision to be made accurately through the drape. The drape prevents wound infection from the surrounding area and the cut edges reinforce the wound edges.
  - (c) The incision to be closed by surface suture strips and, if necessary, covered by an adhesive dressing (e.g. ward dressing) adhering to the surface of the drape and the whole assembly to be left in contact with the body surface until the incision is healed.

It may be convenient for the drape to be transparent to enable the wound to be observed during healing.

The drapes preferably have a matte surface to prevent light reflection especially for use in an operating theatre.

Surgical drapes must be highly conformable to skin otherwise after an incision has been made the retraction of the skin from the incision would cause the drape to lift and allow blood etc. to pass between the drape and the skin. The backing material is preferably anti-static.

Another use of the present invention is in suture strips. At present wounds either caused by accident or caused during surgical treatment are generally closed by stitching. The present invention, however, provides small flexible strips which may be used to prevent a wound from opening up.

The strips should have sufficient rigidity and cohesive properties to achieve the desired result. The suture strips may be mounted on a release coated paper or film strip and packaged in a sterile pack, such as a film or coated paper peel pack. The size and shape of the suture strips may, of course, be varied as desired. The following three forms have, however, been found to be of particular use.

1. Thin strips e.g.  $1/8" \times 3"$  mounted in multiples of 5 or 10 on release coated rectangular strip.

2. Rectangular strips e.g.  $1/4" \times 2"$  with a central absorbent pad, non adherent strip or a central reinforced area either mounted in groups on a release coated sheet or individually wrapped with a protective facing.

3. A "butterfly" shape i.e. wide ends and narrow waist either mounted in groups on a release coated sheet or individually wrapped with a protective facing.

Preferred backing materials for use in the production of the suture strips are the same as those given for the surgical dressings.

Preferred adhesives are polyvinyl ethyl ethers.

The suture strips may be wholly or partially reinforced with woven or non-woven fabrics, for example spun-bonded fabrics such as "Reemay" (as sold by E. I. DuPont de Nemours) or fabrics formed from "Heterofil" fibres (as marketed by I.C.I.). A fabric reinforcement may be present in any layer of the suture strip, for example on the uncoated film surface.

The suture strips preferably have a small amount of elasticity to aid closure of the wound. The strip is adhered to one side of the wound and is then held under tension while adhering to the other side of the wound.

The suture strips of the present invention have a number of advantages as set out below.

1. The moisture vapour and gas permeability properties enable the strips to be left in position for as long as 10 days without irritation and trauma of the skin.
2. Waterproof properties prevent removal by external water or wound exudate.
3. The strips may be used for tissue grafts.

Another particular preferred use of the present invention is in elastic adhesive bandages and strapping tapes. These products comprise lengths of the adhesive material described above and are generally in the form of reels. Since in some cases the adhesive will tend to adhere strongly to the backing material when in reel form, it is desirable to use either a release coat on the backing material or a protector on the adhesive.

The preferred continuous backing materials for strapping tapes are films of copolymers of EEMA/HEMA (provided the amount of HEMA does not exceed 30% by volume); EEMA/HPMA; EEMA/MMA MEMA/HEMA (provided the amount of HEMA does not exceed 30% by volume) and EEMA/MEMA reinforced by woven or nonwoven fabrics. Preferred discontinuous backing materials for strapping tapes include woven and non-woven fabrics with good tensile strength.

The preferred backing materials for elastic bandages are knitted fabrics e.g. knitted



nylon, fabrics containing elastic threads, and high twist cotton fabrics (elastic bandages) which may be coated with poly-ethoxy ethyl methacrylate or thermoplastic polyurethane.

5 The preferred adhesive is polyvinyl ethyl ether.

The backing material for the elastic bandages preferably has a high degree of stretch with good recovery properties whereas when used as a strapping tape the backing material is preferably more rigid, although it must still be flexible.

The main advantage with the bandages and strapping tapes is that they are waterproof yet moisture vapour and gas permeable thus allowing the bandages or tapes to be adhered to the skin without irritation or trauma developing.

The invention will now be described with reference to the following examples. In these examples where reference is made to moisture vapour permeabilities the units are gms/sq. metre/24 hrs/40° C/80% RH.

#### EXAMPLE 1

25 One surface of a backing material in the form of a light weight fabric (weight 1 oz/sq.yd) formed from "Heterofil" fibres based on nylon was given a primer coat of "Gentac" and adhesive composition A (described below) was then applied to the primer coated surface of the fabric in an amount of 75 gm./sq. meter. The moisture vapour permeability of the adhesive material so produced was 500.

35 The adhesive coated material was made into first aid dressings by cutting to an appropriate size and applying a pad to part of the adhesive surface. The dressing gave satisfactory results and did not produce skin maceration due to having too low a moisture vapour permeability.

#### EXAMPLE 2

45 One surface of a backing material in the form of a light weight fabric (weight 1 oz/sq.yd.) formed from Heterofil fibres based on nylon was given a primer coat of "Gentac" and adhesive composition B (described below) was then applied to the primer coated surface of the fabric in an amount of 70 gm/sq metre. The moisture vapour permeability of the adhesive material so produced was 835.

50 The adhesive coated material was made into first aid dressing by cutting to an appropriate size and applying a pad to part of the adhesive surface. The dressing gave satisfactory results and did not produce skin maceration due to having too low a moisture vapour permeability.

#### EXAMPLE 3

60 An adhesive composition was prepared by dissolving a copolymer (Shawinigan D 260) of acrylic esters in a solvent system consisting

of toluene hexane/ethyl acetate. This adhesive was knife coated on to a microporous poly vinyl chloride foil having a moisture vapour permeability of 4500. Dry coating weight was 50 g/sq.m. Dressings made from this showed a moisture vapour permeability of 550 and adhered well to skin.

No skin maceration developed in user trials.

#### EXAMPLE 4

The moisture vapour permeability of the adhesive of Example 3 was increased by the addition of a poly methyl vinyl ether. ("Lutanol" M40—"Lutanol" is a registered Trade Mark).

A 50/50 blend on a solids basis was knife coated on to microporous P.V.C. foil at a dry coating weight of 75 g/sq.m. Dressings made from this had a moisture vapour permeability of 780. The dressings performed well in user trials, although adhesives based on methyl vinyl ethers alone were not expected to possess sufficient water resistance for this purpose.

#### EXAMPLE 5

Adhesive composition C (described below) was knife coated on to microporous P.V.C. foil at a dry coating weight of 72 g/sq.m.

This gave dressings having moisture vapour permeability higher than that given by a similar formulation based on ethyl vinyl ethers without the poly hydroxy propyl acrylate (HPA), e.g. a moisture vapour permeability 555 was increased to 667 by this addition of HPA.

#### EXAMPLE 6

A cast film of 0.0025" thick and consisting of a copolymer of 80% by volume EEMA and 20% by volume HEMA with its casting paper still attached was spread with a solvent based polyvinyl ethyl ether pressure sensitive adhesive (adhesive composition A). The amount of adhesive was 16 grams per square metre. The adhesive was then dried in an oven and the coated film mounted on to a release coated paper protector. The casting paper was then removed and the laminate made into a kit of individual nail covers. The film alone had a moisture vapour permeability of 1400, the adhesive a moisture vapour permeability of 3000 and the completed nail cover a moisture vapour permeability of 960.

A trial showed that the nail covers performed adequately and did not cause damage to the nail.

#### EXAMPLE 7

A first aid dressing was made up using a 0.002" cast film (copolymer of 20% by volume HEMA and 80% by volume EEMA) and the film coated with 30 grams per sq. metre of a polyvinyl ethyl ether adhesive

(adhesive composition A). A protector consisting of a low release silicone coated parchment (No. E1952 as marketed by Leonard Stace Ltd.) was applied to the adhesive surface of the dressing which had a moisture vapour permeability of 690.

#### EXAMPLE 8

A surgical drape was made up by coating a 0.002" thick cast film (20% by volume HEMA 80% by volume EEMA copolymer) with 16 grams per square meter of a polyvinyl ethyl ether adhesive (adhesive composition A). The marginal edges on two opposed parallel sides were left unspread. A silicone release coated paper was applied to the adhesive as a protector. The moisture vapour permeability of the surgical drape (excluding the protector) was 1080.

#### EXAMPLE 9

A 1.6 oz per square yard spun bonded non-woven fabric (Reemay type 2415) was laminated to an 0.002" thick cast film (copolymer of 20% by volume HEMA and 80% by volume EEMA). The film side was then coated with 90 grams per square metre of a polyvinyl ethyl ether adhesive (adhesive composition A) and a release coated card was then applied to the adhesive surface. The resulting laminate was split into 1/8" by 3" strips which were then packed in a peel pack to be used as suture strips. The suture strips had a moisture vapour permeability of 340.

#### EXAMPLE 10

A cast film of 0.0025" thick and consisting of a copolymer made by copolymerising a mixture 50% by volume EEMA and 50% by volume MEMA with its casting paper still attached was spread with a solvent based polyvinyl ethyl ether pressure sensitive adhesive (adhesive composition A). The amount of adhesive was 16 grams per square metre. The adhesive was then dried in an oven and the coated film mounted on to a release coated paper protector. The casting paper was then removed and the laminate made into a kit of individual nail covers. The nail covers (excluding the protector) had a moisture vapour permeability of 940.

Nail covers in accordance with this example were given to 20 volunteers and used for 72 hours or more.

Examination of the nails shows that no significant nail damage occurred when compared with a conventional nitrocellulose lacquer used as a control. The nail covers had an excellent appearance and did not cause any irritation.

#### EXAMPLE 11

A first aid dressing was made up using a 0.002" cast film (of a copolymer obtained by copolymerising a mixture of 50% by

volume MEMA and 50% by volume EEMA) and the film coated with 30 grams per sq. metre of a polyvinyl ethyl ether adhesive (adhesive composition A). A protector consisting of a low release silicone coated parchment (No. E1952 as marketed by Leonard Stace Ltd.) was applied to the adhesive surface of the dressing.

The dressing (excluding protector) had a moisture vapour permeability of 780.

#### EXAMPLE 12

A surgical drape was made up by coating a 0.002" thick cast film (of a copolymer obtained by copolymerising a mixture of 50% by volume MEMA 50% by volume EEMA) with 16 grams per sq. metre of a polyvinyl ethyl ether adhesive (adhesive composition A). The marginal edges on two opposed parallel sides were left unspread. A silicone release coated paper was applied to the adhesive as a protector. The drape (excluding protector) had a moisture vapour permeability of 1080.

#### EXAMPLE 13

A 1.6 oz per square yard spun bonded non-woven fabric (Reemay type 2415) was laminated to an 0.002" thick cast film (of a copolymer obtained by copolymerising a mixture of 50% by volume MEMA and 50% by volume EEMA). The film side was then coated with 90 grams per square metre of a polyvinyl ethyl ether adhesive (adhesive composition A) and a release coated card was then applied to the adhesive surface. The resulting laminate was split into 1/8" by 3" strips where were then packed in a peel pack to be used as suture strips. The suture strips (excluding protector) had a moisture vapour permeability of 350.

#### EXAMPLE 14

Adhesive composition D (see below) was knife coated onto a silicone coated release paper, to give a dry coating weight of 60 g.s.m. After drying, a spun-bonded fabric ("Reemay" 2415) was laminated to the adhesive and the release paper stripped away. Small dressing pads were placed on the adhesive, and first aid dressings cut out.

The dressings had a moisture vapour permeability of 1100, adhered satisfactorily to human skin, and did not cause skin maceration or irritation.

#### EXAMPLE 15

Adhesive composition E (see below) was knife coated onto a release paper to give 40 g.s.m. dry coating weight. The dry adhesive was transferred by lamination to a non-woven spun-bonded polyester fabric having an appreciable degree of stretch and recovery (No. 1520 by Bondina Ltd).

This was then cut into strips 3" wide by 3 yards long and rolled up with a silicone paper

interleaf for use as adhesive compression bandages. These bandages had a M.V.P. of 1100 units.

#### EXAMPLE 16

- 5 Adhesive materials were prepared from a backing material of a polymer obtained by copolymerising a 50/50 mixture of EEMA/MEMA and adhesive composition A (see below). The accompanying drawing shows the moisture vapour permeability of these various films in the form of a graph (log/log scale) in which moisture vapour permeability (along the ordinate or y axis) is plotted against mass of adhesive (along the abscissa or x axis) (gm/sq metre) for the adhesive alone (line A), the adhesive on 0.001" (line B); 0.0015" (line C), 0.002" (line D); 0.0025" (line E) and 0.0030" (line F) backings.

#### EXAMPLE 17

- 20 A self crosslinking acrylic ester copolymer in ethyl acetate solution (Acronal KR 2156 supplied by BASF "Acronal" is a registered Trade Mark) was reverse roll coated onto a 1 mil thick polyurethane film (Estane 5702 solution cast) to give a dry coating weight of 60 g.s.m.

Moisture vapour permeability  
Tensile strength  
Yield point  
Elongation at break

525 ± 25  
2.2 ± 0.3 lb/in  
1.7 ± 0.1 lb/in.  
300 ± 40%

#### EXAMPLE 19

- 60 Example 10 was repeated using a 0.0021" ( $\pm 0.0002$ ") film and an adhesive spread of 18 gm/sq metre.

The moisture vapour permeability of the film alone was 1800 and of the film coated with adhesive was 1050.

#### EXAMPLE 20

- 65 A 0.011" microporous plasticised PVC film was given 60 g.s.m. coating of adhesive composition A by transfer from a silicone release coated paper. The coated film was made up into small first aid dressings and used in a clinical trial on volunteers for healing cuts, abrasions and blisters on the fingers. Of the 500 dressings used only 3

The polyurethane film, with the wet coating of adhesive solution was passed through a hot air drying tunnel at 75° C which caused the adhesive to foam up as it dried.

At the reel up, a siliconised paper interleaf was laminated to the adhesive, passing through nip rollers applying sufficient pressure to burst much of the foam (50 p.s.i. on the actuating cylinders of a Dixon coater model 160, 12" wide).

Samples of film/adhesives tested for MVP gave a figure of 820.

Similar film coated with Acronal KR 2156, but not foamed, gave an MVP figure of 550 units.

#### EXAMPLE 18

A surgical drape was made up by coating a 0.0032" ( $\pm 0.002$ ") thick cast film of a copolymer obtained by copolymerising a mixture of 50% by volume MEMA and 50% by volume EEMA with 50 gms/sq metre of adhesive composition A. The marginal edges on two opposed parallel sides were left unspread. A silicone release coated paper was applied to the adhesive as a protector. The surgical drape (excluding protector) had the following properties.

showed signs of maceration, attributed to lifting and ingress of water. In all other cases the wound healing was satisfactory over the periods of inspection varying from 5 hours to 3 days.

The dressings had a moisture vapour permeability of 600.

It will be appreciated that the materials used in the Examples are for illustration only and many other materials could be used, e.g. the 50/50 EEMA/MEMA copolymer used in Examples 12 and 13 could be replaced by say a 70/30 MEMA/EEMA or 60/40 MEMA/EEMA copolymer.

The following are adhesive compositions used in many of the above Examples.

#### Adhesive Composition A

|                         |   |
|-------------------------|---|
| Bakelite EDBC           | 50 parts by weight                            |
| Bakelite EHBM           | 100 parts by weight (of solution as received) |
| Kelrez ZR142            | 25 parts by weight                            |
| Antioxidant (Nonox WSL) | 3 parts by weight                             |
| 60—80 petroleum ether   | 300 mls.                                      |

The Bakelite EDBC and the Bakelite EHBM were mixed together in a two blade mixer and the Nonox WSL and Kelrez ZR142 was added as a 25% solution in a portion of the petroleum ether. When the mass

had been thoroughly mixed it was diluted to working viscosity using the rest of the petroleum ether.

This polyvinyl ethyl ether adhesive has an oxygen permeability, when coated as a

0.0126" layer (70—74 gm/sq.metre) on a microporous P.V.C. base, of 5000 cc/sq. metre/24 hours/atms.

#### Adhesive Composition B

An adhesive composition was prepared by dissolving in 60 to 80 petroleum ether solvent, the following ingredients:

|    |               |   |
|----|---------------|---|
| 10 | Bakelite EHBM | 1 part by weight                        |
|    | Bakelite EDBC | 1 part by weight (of solution received) |
|    | Kelrez ZR142  | 0.5 parts by weight.                    |

#### Adhesive Composition C

This adhesive was prepared from the following ingredients:—

|    |                              |                 |
|----|------------------------------|-----------------|
| 15 |                              | parts by weight |
|    | Bakelite EDBC                | 30              |
| 20 | Bakelite EHBM                | 85.2            |
|    | Kelrez ZR142                 | 15.35           |
|    | Poly hydroxy propyl acrylate | 33.35           |
| 20 | Ethanol                      | 130             |
|    | 60/80 petroleum ether to     | 40% solids      |

#### Adhesive Composition D

An adhesive was made up to the following formulation:—

|    |   |                 |
|----|---|-----------------|
| 25 |   | parts by weight |
|    | Acronal 40D                                       | 50              |
| 30 | Lutanol M40 (aq.)                                 | 50              |
|    | This adhesive had the following properties        |                 |
|    | Williams plasticity $K_3^{40}$                    | 273             |
|    | Peel adhesion to steel at 60 g.s.m. (To B.S.2J10) | 530 g/cm width. |

Moisture vapour permeability at 60 g.s.m. (on film with water vapour permeability of 1915); 1075.

#### Adhesive Composition E

An adhesive was made up to the following formulation:—

|    |  |                 |
|----|--|-----------------|
| 40 |  | Parts by weight |
|    | Gantrez M574   | 100             |
|    | Gelva D260   | 20              |
|    | Kelrez ZR 142  | 25              |
| 45 | The following test results were obtained at 60 g.s.m. coating weight:— |                 |
|    | Williams plasticity $K_3^{40}$   | 120             |
|    | Moisture permeability (on film of M.V.P. 1915)                         | 752.            |

The following are descriptions of some of the materials referred to in the general description and in the Examples.

Bakelite Resin EHBM is a Poly (vinyl ethyl ether) high viscosity resin having 25% non-volatiles in hexane, a reduced viscosity at 20° C. of  $4.0 \pm 0.5$ ; a plasticity of 1.6 to 2.0 mm; a flash point  $< 20^\circ$  F; a specific gravity of 0.7299 and a weight per gallon of 6.07 lbs.

Bakelite Resin EDBC is a Poly (vinyl ethyl ether) low viscosity resin having 98% non-volatiles; a reduced viscosity at 20° C. of  $0.3 \pm 0.1$ ; a specific gravity at 20° C. of 0.973 and a weight per gallon of 8.12 lbs.

Kelrez ZR142 is a zinc resinate formed by the interaction of zinc oxides with the resin acids in partially dimerised Colophony, contains 9.6% zinc and has a melting point of 160 to 165° C.

Acronal 40D is an aqueous dispersion of acrylic polymers (50% solids) sold by B.A.S.F.

Lutanol M40 (aq) is a soft polymer of methyl vinyl ether dissolved in water (50% solids) sold by B.A.S.F.

Gantrez M574 is a solution of poly(methyl vinyl ether) sold by General Aniline and Film Corporation.

Gelva D260 is a solution of copolymers of acrylic alkyl esters sold by General Aniline and Film Corporation.

Gentac is a butadiene/vinyl-pyridine copolymer latex.

"Bakelite", "Nonox", "Acronal", "Lutanol", "Gantrez", "Gelva" and "Gentac" referred to in the compositions detailed above are registered Trade Marks.

The EEMA used in Examples 6 and 13, and 19 containing 2-ethoxy ethylmethacrylate for the most part together with a very small proportion of acid as an impurity.

The HEMA used in Examples 6 to 9 contained 2-hydroxy ethyl methacrylate for the most part, together with a small amount of di-ethylene glycol monomethacrylate, ethylene glycol dimethacrylate and methacrylic acid as impurities.

The EEMA/HEMA copolymer film of Example 8 has an oxygen permeability transmission rate when measured according to B.S. 2782: 1965 method 514A, was found to be 5000 ml/sq. metre/24 hours/atms/thou. thickness.

The polyhydroxy propyl acrylate was prepared by polymerizing hydroxy propyl acrylate in ethanol using benzoyl peroxide catalyst to give a solid rubbery polymer soluble in ethanol.

The moisture vapour permeabilities of a number of the continuous backing materials used in accordance with the present invention are given below:—

|    | Film                                | Thickness<br>(X.0.001") | Moisture vapour perme-<br>ability(g/sqm/24 hrs<br>at 40° C. & 80% RH) |
|----|-------------------------------------|-------------------------|---|
| 5  | EEMA                                | 4.5                     | 880   |
|    | EEMA/HEMA (80:20)                   | 2.5                     | 1400  |
|    | EEMA/Methyl Methacrylate<br>(80:20) | 2.5                     | 1020  |
|    | MEMA                                | 4.3                     | 1140  |
| 10 | MEMA/Methyl Methacrylate<br>(90:10) | 2.0                     | 1650  |
|    | MEMA/HEMA (90:10)                   | 1.5                     | 2460  |
|    | MEMA/EEMA (50:50)                   | 2.1                     | 1800  |
|    | MEMA/EEMA (70:30)                   | 2.7                     | 1650  |

# WHAT WE CLAIM IS:—

- 15 1. A moisture vapour permeable pressure sensitive adhesive material for use on animal skin and nails, comprising a backing material having a pressure sensitive adhesive on at least substantially the whole of the body adhering portion of at least one surface of said back material, both said backing material and said adhesive being moisture vapour permeable and unaffected by water and at least one of said backing material and said adhesive comprising a synthetic polymer and being continuous and non-permeable to liquid water, said adhesive material having a moisture vapour permeability of at least 300 g./sq. metre/24 hours/40° C./80 percent RH.
- 20 2. A pressure sensitive adhesive material as claimed in claim 1, which has a moisture vapour permeability of at least 500 g./sq. metre/24 hours at 40° C and 80% RH.
- 25 3. A pressure sensitive adhesive material as claimed in claim 1 or 2, which is oxygen permeable.
- 30 4. A pressure sensitive adhesive material as claimed in claim 1, 2 or 3 in which the backing material is continuous and the adhesive is not continuous.
- 35 5. A pressure sensitive adhesive material as claimed in claim 4, in which the discontinuities in the adhesive are achieved by foaming, leaching out solid filler, pattern spreading, spraying or selective layer performing.
- 40 6. A pressure sensitive adhesive material as claimed in any one of the preceding claims, which is in the form of a surgical drape suture strip or sheet, adhesive dressing, bandage, plaster, strapping tape, decorative nail covering, or decorative cosmetic product.
- 45 7. A moisture vapour permeable pressure sensitive adhesive material for use on animal skin and nails comprising a backing material having a pressure sensitive adhesive on at least substantially the whole of the body-adhering portion of at least one surface of said backing material, both said backing material and said adhesive being moisture vapour permeable and unaffected by water and at least said adhesive comprising a synthetic polymer and being continuous and nonpermeable to liquid water, said adhesive material having a moisture vapour permeability of at least 300 g./sq. metre/24 hours/40° C./80 percent RH.
- 50 8. A pressure sensitive adhesive material as claimed in claim 7, in which the adhesive is a blend of vinyl ethers or an acrylic polymer.
- 55 9. A pressure sensitive adhesive as claimed in claim 7 or 8, in which the adhesive is a polyvinyl ethyl ethers or an acrylic ester copolymer containing hydrophilic groups.
- 60 10. A pressure sensitive adhesive material as claimed in any one of claims 7 to 9 in which the backing material is non-continuous.
- 65 11. A pressure sensitive adhesive material as claimed in claim 10, in which the backing material is a microporous film of plasticised polyvinyl chloride or a non-woven fabric.
- 70 12. A pressure sensitive adhesive material as claimed in claim 11, in which the non-woven fabric is based on cellulose or synthetic polymer fibres which may be crimped and/or laid down in such a manner as to give an elastic fabric.
- 75 13. A pressure sensitive adhesive material as claimed in claim 12, in which the fabric comprises extruded composite synthetic fibres or a spun-bonded polyester fabric.
- 80 14. A pressure sensitive adhesive material as claimed in any one of claims 7 to 13, which also includes a vapour permeable tie coating between said backing material and said adhesive.
- 85 15. A pressure sensitive adhesive material as claimed in any one of claims 7 to 14, in which the backing material is impregnated with a thin coat of a flexible and extensible material on the exposed surface of the backing material.
- 90 16. A pressure sensitive adhesive material as claimed in any one of claims 7 to 15 which is in the form of a bandage, plaster, strapping or dressing.
- 95 17. A pressure sensitive adhesive material as claimed in claim 16 which is in the form of a dressing and a pad is attached to the adhesive coated surface of the material.
- 100 18. A pressure sensitive adhesive material as claimed in any one of claims 7 to 17

which also comprises a protector over the adhesive.

19. A pressure sensitive adhesive material as claimed in Claim 18, in which the protector comprises a silicone release coated paper.

20. A moisture vapour permeable pressure sensitive adhesive material for use in animal skin and nails, comprising a backing material having a pressure sensitive adhesive on at least substantially the whole of the body adhering portion of at least one surface of said backing material, both said backing material and said adhesive being moisture vapour permeable and unaffected by water and both said backing material and said adhesive comprising a synthetic polymer and being continuous and non-permeable to liquid water, said adhesive material having a moisture vapour permeability of at least 300 g./metre/24 hours/40° C./80 percent RH.

21. A pressure sensitive adhesive material as claimed in claim 20 in which the backing material comprises a copolymer obtainable by copolymerising an hydroxy alkyl acrylate or methacrylate with an alkoxy alkyl acrylate or methacrylate and optionally with a minor amount of a further monomer.

22. A pressure sensitive adhesive material as claimed in claim 21, in which the minor amount of further monomer is no more than 10% by volume based on the total volume of monomers.

23. A pressure sensitive adhesive material as claimed in claim 21 or 22, in which further monomers comprises acrylic acid, methacrylic acid, acrylamide, a mono- or di-acrylate of a glycol or poly glycol, a mono- or di-methacrylate of a glycol or polyglycol, glycidyl acrylates and glycidyl methacrylates.

24. A pressure sensitive adhesive material as claimed in any one of claims 21 to 23, in which the hydroxy alkyl acrylate or methacrylate comprises a hydroxy ethyl methacrylate (HEMA), a hydroxy propyl acrylate (HPA) or a hydroxy propyl methacrylate (HPMA).

25. A pressure sensitive adhesive material as claimed in any one of claims 21 to 24, in which the alkoxy alkyl acrylate or methacrylate comprises an ethoxy ethyl methacrylate (EEMA) or a methoxy ethyl methacrylate (MEMA).

26. A pressure sensitive adhesive material as claimed in claim 20, in which the backing material comprises a homopolymer of an alkoxy alkyl acrylate or methacrylate (linear or cross-linked) or a copolymer of an alkoxy alkyl acrylate or methacrylate with an alkyl acrylate or methacrylate.

27. A pressure sensitive adhesive material as claimed in claim 26, in which the backing material comprises a homopolymer of an ethoxy ethyl methacrylate (EEMA) or a methoxy ethyl methacrylate (MEMA) or a co-

polymer of methyl methacrylate (MMA) with an ethoxy ethyl methacrylate or a methoxy ethyl methacrylate.

28. A pressure sensitive adhesive material as claimed in claim 20 in which the backing material comprises a thermoplastic polyurethane film.

29. A pressure sensitive adhesive material as claimed in any one of claims 20 to 28, in which the adhesive comprises a polyvinyl ethyl ether.

30. A pressure sensitive adhesive material as claimed in any one of claims 20 to 29 in which the backing material is provided with a release coating or a protector is applied over the adhesive surface.

31. A pressure sensitive adhesive material as claimed in any one of claims 20 to 30, in which the backing material or adhesive or both have a pattern of thinner areas.

32. A pressure sensitive adhesive as claimed in any one of claims 20 to 31, which is in the form of a nail cover, a medical or surgical dressing, a surgical drape, a suture strip, an elastic adhesive bandage or a strapping tape.

33. A pressure sensitive adhesive material as claimed in claim 32, which is in the form of a nail cover, a medical or surgical dressing, a surgical drape or a suture strip, and in which the backing material is a copolymer of EEMA/HEMA (provided the amount of HEMA does not exceed 30% by volume); a copolymer of EEMA/HPMA; a copolymer of MEMA/HEMA (provided the amount of HEMA does not exceed 30% by volume), a copolymer of EEMA/MMA or a homopolymer of MEMA.

34. A pressure sensitive adhesive material as claimed in claim 33, in which the backing material comprises an 80/20 (volume/volume) or a 75/25 (volume/volume) copolymer of EEMA/HEMA; a 90/10 (volume/volume) or an 80/20 (volume/volume) copolymer of EEMA and MMA; and 80/20 (volume/volume) copolymer of EEMA/HPMA; a 90/10 (volume/volume) or an 80/20 (volume/volume) copolymer of MEMA/HEMA or cross linked versions of these polymers.

35. A pressure sensitive adhesive material as claimed in claim 32, 33 or 34, which is in the form of a nail cover and in which the backing material has a thickness of from 1 to 3 mils.

36. A pressure sensitive adhesive material as claimed in any one of claims 32 to 35 which is in the form of a nail cover and in which the adhesive is applied in an amount of from 5 to 75 grams per square metre.

37. A pressure sensitive adhesive material as claimed in any one of claims 32 to 36, which is in the form of a nail cover and in which the backing material has a glossy finish.

38. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34, which is in the form of a medical or surgical dressing and includes an absorbent pad on the adhesive face of the material and a film or release coated paper protector covering the adhesive and pad.
39. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 or 38 which is in the form of a medical or surgical dressing and in which the backing material includes an elastic fabric.
40. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 which is in the form of a surgical drape, and which includes, a film or release coated protector over the adhesive coated area.
41. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 or 40 which is in the form of a surgical drape and which incorporates a bacteriostatic agent.
42. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34, 40 or 41 which is in the form of a surgical drape and part of which is reinforced.
43. A pressure sensitive adhesive material as claimed in claim 42 in which the backing material is reinforced with a light weight spun bonded non-woven fabric.
44. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 or 40 to 43 which is in the form of a surgical drape and which is transparent.
45. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 or 40 to 44 which is in the form of a surgical drape and which has a matt surface.
46. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 or 40 to 45 which is in the form of a surgical drape and in which the backing material has been made anti-static.
47. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 which is in the form of a suture strip and which is mounted on a release coated paper or film strip and packaged in a sterile pack.
48. A pressure sensitive adhesive material as claimed in any one of claims 32 to 34 or 47 which is in the form of a suture strip and which is wholly or partially reinforced with woven or non-woven fabrics.
49. A pressure sensitive adhesive material as claimed in claim 32 which is in the form of an elastic bandage or a strapping tape and which includes a release coat on the backing material or a protector on the adhesive.
50. A pressure sensitive adhesive material as claimed in claim 32 or 49 which is in the form of a strapping tape and in which the backing material comprises a copolymer of EEMA/HEMA (provided the HEMA does not exceed 30% by volume); a copolymer of EEMA/HPMA; a copolymer of EEMA/MMA or a copolymer of MEMA/HEMA (provided the HEMA does not exceed 30% by volume) reinforced by woven or non-woven fabrics.
51. A pressure sensitive adhesive material as claimed in claim 32 or 49 which is in the form of an elastic bandage and in which the backing material comprises a knotted fabric, a fabric containing elastic threads, or a high twist cotton fabric coated with a poly-ethoxy ethyl methacrylate.
52. A pressure sensitive adhesive material as claimed in claim 32 or 49 which is in the form of an elastic bandage and in which the backing material comprises a knitted fabric, a fabric containing elastic threads, or a high twist cotton fabric coated with a thermoplastic polyurethane.
53. A pressure sensitive adhesive material as claimed in claim 20, in which the backing material comprises a copolymer obtainable by reacting an alkoxy alkyl acrylate or methacrylate with a different alkoxy alkyl acrylate or methacrylate, no monomers other than alkoxy alkyl acrylates or methacrylates or polymers formed therefrom being present in the reaction mixture.
54. A pressure sensitive adhesive material as claimed in claim 53, in which the backing material comprises a copolymer of an ethoxyethyl methacrylate (EEMA) and a methoxy ethyl methacrylate (MEMA).
55. A pressure sensitive adhesive material as claimed in claim 54, in which the backing material comprises a 50/50 (volume/volume), 60/40 (volume/volume) or 70/30 (volume/volume) copolymer of MEMA/EEMA.
56. A pressure sensitive adhesive material as claimed in any one of claims 53 to 55, in which the adhesive comprises a polyvinyl ethyl ether.
57. A pressure sensitive adhesive material as claimed in any one of claims 53 to 56, in which the backing material is provided with a release coating or a protector is applied over the adhesive surface.
58. A pressure sensitive adhesive material as claimed in any one of claims 53 to 57, in which the backing material or adhesive or both have a pattern of thinner areas.
59. A pressure sensitive adhesive material as claimed in any one of claims 53 to 58, which is in the form of a nail cover, a medical or surgical dressing, a surgical drape, a suture strip, an elastic adhesive bandage or a strapping tape.
60. A pressure sensitive adhesive material as claimed in claim 59, which is in the form of a nail cover and the backing material has a thickness of from 1 to 3 mils.
61. A pressure sensitive adhesive material as claimed in claim 59 or 60, which is in the form of a nail cover and in which the adhesive is applied in an amount of from 5 to 75 grams per square metre.
62. A pressure sensitive adhesive material



- as claimed in any one of claims 59 to 61 which is in the form of a nail cover and in which the backing material has a glossy finish.
- 5 63. A pressure sensitive adhesive material as claimed in claim 59 which is in the form of a medical or surgical dressing and includes an absorbent pad on the adhesive face of the material and a film or release coated paper protector covering the adhesive and pad.
- 10 64. A pressure sensitive adhesive material as claimed in claim 59 or 63 which is in the form of a medical or surgical dressing and in which the backing material includes an elastic fabric.
- 15 65. A pressure sensitive adhesive material as claimed in claim 59 which is in the form of a surgical drape, and which includes a film or release coated protector over the adhesive coated area.
- 20 66. A pressure sensitive adhesive material as claimed in claim 59 or 65 which is in the form of a surgical drape and which incorporates a bacteriostatic agent.
- 25 67. A pressure sensitive adhesive material as claimed in any one of claims 59, 65 or 66 which is in the form of a surgical drape and part of which is reinforced.
- 30 68. A pressure sensitive adhesive material as claimed in claim 67 in which the backing material is reinforced with a light weight spun bonded non-woven fabric.
- 35 69. A pressure sensitive adhesive material as claimed in any one of claims 59 or 65 to 68 which is in the form of a surgical drape and which is transparent.
- 40 70. A pressure sensitive adhesive material as claimed in any one of claims 59 or 65 to 69 which is in the form of a surgical drape and which as a matt surface.
- 45 71. A pressure sensitive adhesive material as claimed in any one of claims 59 or 65 to 70 which is in the form of a surgical drape and in which the backing material has been made anti-static.
72. A pressure sensitive adhesive material as claimed in claim 59 which is in the form of a suture strip and which is mounted on a release coated paper or film strip and packaged in a sterile pack.
- 50 73. A pressure sensitive adhesive material as claimed in claim 59 or 72 which is in the form of a suture strip and which is wholly or partially reinforced with woven or non-woven fabrics.
- 55 74. A pressure sensitive adhesive material as claimed in claim 59 which is in the form of an elastic bandage or a strapping tape and which includes a release coat on the backing material or a protector on the adhesive.
- 60 75. A pressure sensitive adhesive material as claimed in claim 59 or 74 which is in the form of an elastic bandage and which comprises a knitted fabric, a fabric containing elastic threads or a high twist cotton fabric coated with a copolymer as defined in any one of claims 53 to 55.
- 65 76. A pressure sensitive adhesive material as claimed in claim 59 or 74, which is in the form of an elastic bandage and in which the backing material comprises a knitted fabric, a fabric containing elastic threads, or a high twist cotton fabric coated with a thermoplastic polyurethane.
- 70 77. A pressure sensitive adhesive material substantially as hereinbefore described with reference to any one of Examples 1, 3, 4 and 5.
- 75 78. A pressure sensitive adhesive material substantially as hereinbefore described with reference to Example 2.
- 80 79. A pressure sensitive adhesive material substantially as hereinbefore described with reference to any one of Examples 6 to 9.
- 85 80. A pressure sensitive adhesive material substantially as hereinbefore described with reference to any one of Examples 10 to 13.
- 90 81. A pressure sensitive adhesive material substantially as hereinbefore described with reference to any one of Examples 14 to 20.

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COMPLETE SPECIFICATION

1 SHEET

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